URBAN DESIGN ISSUES RELATED TO TRANSPORTATION MODES, DESIGNS AND SERVICES FOR NEO-TRADITIONAL DEVELOPMENTS

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What I thought I could best do in my allotted time here is to talk briefly about how urban design, what I prefer to call the built environment, affects travel. First, I will review principles of how one creates built environments that meaningfully affect travel, and then look at some ecological dilemmas in measuring these impacts. Then I will turn to several studies my students and I have been involved with during the last several years addressing this question, quite admittedly only coming up with partial insights into these questions. I will try to show how we have tried to add some degree of sophistication and new methodological approaches to hopefully better illuminate our understanding of the subjects. Indeed, much of that work has involved triangulating research designs. We have tried to look at these relationships using different data sets and different methodological approaches and, hopefully, collectively we begin to get insights and patterns. Let me begin with this simple view graph which shows on the top Kensington, Maryland, in 1890 and on the bottom Seaside, Florida, in 1990 a century later. I think it pictorially shows what many traditional town planning principles are about. They borrow design themes and elements from turn-of-the-century American communities, often New England towns and Southern towns like Williamsburg, and try to graph them on a contemporary urban fabric. A dominant feature of the traditional town is a walkable scale wherein many activities are within a quarter to half mile of residents. You see in both designs—Kensington and Seaside—a modified or broken grid patterns of streets. The idea is to open up as many more connections and destinations as possible through a finer grain grid. Traditional towns also feature prominent civic spaces in the core such as a school or a civic center. Central squares serve as a gathering place for the community, where people congregate for parades, demonstrations, celebrations, and everyday events. Mixes of land uses, housing types, and densities are also prevalent, as are rear lots and back alleys.

It is very important to recognize at the outset that transportation and mobility are not the key objectives of these traditional neighborhood designs. First and foremost urban designers are trying to instill a sense of community, an attachment to place. To some degree, there is an undercurrent of social reform behind these designs. Advocates are trying to create environments where suburbanites are less confined to their cars; instead, the hope is to have people from all walks of life interacting, face-to-face, on a regular basis, thus creating a more socially and culturally diverse urban environment. Studies might show traditional neighborhood designs have very marginal impacts on travel, however, this does not mean we should not create such places. They may be worthwhile doing for other reasons. If nothing else, they are widening our choices in living, working and traveling environments. Anything which expands choices in this postwar era of stereotypical, cookie-cutter suburban development is a very

positive thing.

When thinking about the delicate relationship between travel behavior and urban design it is instructive to think about the three D's, or dimensions, of the built environment. These three dimensions—density, diversity, and design—characterize the prominent features of neo-traditional communities, new urbanism, transit oriented development, or any other urban design scheme. First, let's take density. Most people respond very viscerally to the notion of density, though quite simply we are talking about settings where places are closer to each other. There have been many studies on the effects of density on travel. Here we see a graph where fuel consumption rates per capita decline as a function of residential density, and here we see transit modal splits go up as a function of residential density. The problem is these studies use a simple two-dimensional plane to relate to travel behavior. Many share a strong elastic relationship, however, when you properly control for other factors like the tendency for higher density areas to be home to lower-income households. You find that the contribution of density itself becomes fairly marginal. Most studies show that the big mobility payoff comes from going from low to moderate densities. Plotting trip rates on the vertical axis and density on the horizontal axis shows you get the biggest drop going from extremely low densities to moderate densities. Thus, we are not talking about Hong Kong style densities or even three-story garden apartments everywhere to achieve significant benefits. Often it is when going from about 4 to 5 dwellings per gross acre developments to 12 to 15 that you find the most significant gains in terms of reducing travel consumption. Accessibility is another index of densities or relative proximity. In certain ways, it is an index of how unspread-out development is. To the degree that destinations are relatively close, accessibility is high. People like Reid Ewing have shown that accessibility is the more dominant explainer of people's travel behavior within the communities than is density in and of itself. Of course, density is really a proxy for other things. Dense places tend to have better quality transit services, lower parking provisions, and lower average household incomes. It is all these other things that accompany densities that are really shaping travel choices.

"Diversity," or mixed land uses, is another defining feature of design initiatives in vogue like new urbanism. We are talking about mixed use. A suburban retail strip has mixed uses, but is hardly an urban design paragon. The notion of diversity is land uses that are compatible and that benefit from being close to each other. For residential neighborhoods, the aim is to provide shops within the community. One that convenience trips—trips that people might otherwise be compelled to use their cars and drive out of the neighborhood—are instead made by foot, bicycle, or alternative modes if shops exist within a neighborhood. Retail within neighborhoods might also have some effect on inducing people to use transit to commute to work. Transit commuters can conveniently stop off at the cleaners or the grocery store when retail areas are sited near transit. For offices and other nonresidential land uses, probably what is less understood about mixed land uses is that they can be important inducements toward car pooling or public transit commuting. Those working in a suburban office park with on-site restaurants, retail shops, and ATMs, are going to feel less stranded if they ride share or take transit. Workers retain some midday mobility by virtue of having those activities on site. For the secondary trips, like heading to lunch while at work, mixed uses can induce walking and cycling. Of course, mixed land uses have far more important implications beyond just travel behavior. They allow for more efficient use of land, like shared parking. Office parking can be used evenings and weekends by, say theatergoers if an entertainment complex lies near an office center. Diversity also relates to housing

mixes and modal alternatives. In the suburbs we have experimented some thirty years with fixed-route, fixed-schedule bus service, and still transit carries a small fraction of trips in most areas. Why not open the marketplace to jitneys and commercial vans which can provide superior door-to-door services? By diversity, then, we mean more modal options and live/work options. Diversity cuts across a very wide array of contexts.

The third D in the three dimensions of the built environment is "design". This is perhaps where the neo-traditionalists feel they have the best chance of changing the suburban landscape, by creating grid street patterns, planting street tress, resiting parking, and ensuring high-quality pedestrian provisions. I was scolded a few years ago when I used the word "pedestrian amenities" during a talk. The word "amenity" suggests that we are giving some kind of freebie or frills to pedestrians. Of course, what designers really have in mind is leveling the playing field. The aim is to give the same basic provisions to alternative means of conveyance, like walking and cycling. So it really is a question of basic provisions. Site designs, like providing rear alleys, situating parking to the rear, and all the things that neo-traditionists and new urbanists tout as important and likely have greater social value than transportation benefits. These are things that can begin to bring people together, promoting social interaction and comradery. Transportation is clearly secondary.

The debate over preferred street patterns in suburbia has heated up recently. Randy Crane and a few others have published papers recently contending that the potential benefits of grid street patterns are highly dubious. On the one hand, gridded streets can encourage walking, however, on the other hand, they also increase accessibility for motorists. Their ultimate impact likely depends on the grains of streets and block patterns. Grids laid out in superblocks will probably induce automobile trips. However, a very fine grain grid—what neo-traditionalists call for—with intersections 400 or 500 feet instead of every 1,500 to 2,000 feet, will likely deter motoring. Where cars must stop repeatedly, as with four-way stops, and where preferences are given to pedestrians and cyclists, one is less inclined to drive a car. Thus, I would argue, it is not so much the configurations of streets as it is the grain of designs that are likely to bear on travel behavior. When researching this topic, one has to dig deeper to get a sense of the grain and the details of designs characteristics before one can even begin to understand the effects of new urbanist designs on travel behavior.

Researchers face a number of dilemmas when trying to discover how built environments affect travel demands. To study the influences of mixed land uses and pedestrian-friendly designs on travel, the biggest impacts are likely to be on nonwork trips, and shop trips specifically. Most regional travel surveys, however, rarely have more than two to four household trip records for any one census tract neighborhood. With so few cases it is very hard to associate the design details of neighborhoods with travel demand. The reality is that regional travel surveys are designed to guide investments in large scale regional transportation improvements, not for neighborhood scale planning. In the transportation field we have been blessed with rich data. Since the collapse of HUD's 701 funding for comprehensive planning, we do not have particularly good region wide database on land uses, and virtually nothing on urban design features. To complete data on urban design, one is left with doing primary data collection and maybe drawing information from often incompatible secondary sources. At the neighborhood tract level, quality and compatibility of urban design and land use information lag seriously behind that of

travel data. Statistically, obviously co-linearity problems abound. While I have suggested that built environments sort themselves rather neatly along three dimensions, the reality is that most dense places also tend to be diverse and pedestrian friendly. They also generally enjoy better transit services and parking is more limited. It thus becomes difficult to attribute higher rates of transit riding to density, per se, when these other factors co-exist. Maybe it is counterproductive to attempt to statistically isolate the influences of any one element. What is really important is the synergy and the interaction among factors.

Another dilemma facing researchers is the richness of data. Where we do have land use data and urban design information is often recorded on a simple nominal scale—often binary where either the condition exists or not. For example, a measure of pedestrian provisions is as simple as whether a sidewalk exists or not. Such "dummy variables" are frequently used as crude indications of urban design features. The dilemma is that control variables that go into these analyses, like the price of travel or household income, are much richer, measured on a metric scale. Thus, the predictive odds are often stacked against land use design variables, because of how we measure them and because of the absence of enough rich variation.

Another dilemma of researchers is confounding influences. A lot of developments came on-line in the late '80s and early '90s when real estate markets began to soften and go flat. Projects like the Kentlands in Maryland, a Georgetown look-alike in the suburbs, went belly up and the banks had to assume ownership. What probably had a bigger effect on reduced congestion levels in the early '90s than new urbanist designs was higher unemployment, meaning fewer people were making work trips. Another confounding factor is that many progressively designed places, like developments, invariably introduce TDM programs as well. With cash-out parking, free transit passes, guaranteed rides home, and so on, it is hard to separate out the influences of these policy initiatives from the influences of urban design.

What I want to do with my remaining time is to review several studies that have sought to address and overcome these dilemmas. One approach to deal with measurement and control problems is to take matched pairs—that is, match up neighborhoods which in many characteristics are similar except for their design features. Ideal matches would have comparable incomes and vehicle ownership rates, and comparable levels of transit services, and lie fairly close to each other, but would greatly vary in terms of their design characteristics. When one cannot empirically measure a phenomenon, another approach is simulations. To date, most simulations of urban designs have concentrated almost exclusively on the effects of grid-iron streets and networks. For the most part, these simulations have pretty much assumed the densities and the other design of comparison neighborhoods to be comparable. While this allows researchers to estimate the likely effects of gridded street networks on travel demand, it misses the fact that design treatments need to be bundled together to really begin to exert meaningful influences. Of course, prices probably have the strongest bearing on travel choices. Unless the right prices are set, we are really always scratching at the margin in terms of altering travel behavior through land use initiatives and urban design. Free parking will greatly over shadow any possible influences that urban designs might have on travel choices.

Another approach to understanding the link between travel and design is international comparisons. I certainly have sought to gain insights by looking at experiences abroad, but invariably one must contend with the criticisms of cultural and historical differences in places like Europe and the U.S.

Lastly, the most popular and potentially powerful tools for drawing statistical inferences are predictive models like regression and logit analyses. For the sake of keeping this simple, I will just move on and talk about the application of these techniques in a few minutes.

One study that attempted to cope with many of the methodological dilemmas just outlined is Michael McNally's recent work in Orange County, California. Using 1991 SCAG data and cluster analysis, McNally classified census tracts in Orange County as either:

1) a traditional neighborhoods;
2) Planned Urban Developments (PUD) (e.g., contemporary tract suburban designs); or
3) A hybrid of the two.

McNally used network densities and measures of accessibility as the chief clustering variables. His study showed that indeed traditional neighborhoods averaged significantly lower vehicle trip rates (2.95 trips per household per day versus 4 trips). It is important to note that such studies only consider vehicle trips since regional travel surveys do not usually count pedestrians movements. Thus, there is a built-in bias right at the outset against even recognizing and thus potentially planning for nonmotorized travel. A shortcoming of this study, however, is that Orange County is hardly a place of great land-use diversity. It is probably as uniform of a suburban landscape as can be found in America. I assume that the lower trip rates are partly due to the fact that those who live in older parts of Orange County, like Santa Ana, that feature grid-iron streets and higher densities are disproportionately recent immigrants from lower income households. Thus, are the lower trip rates due to traditional designs, lower income, or both? Such studies cannot really answer this.

Let me briefly review a few other studies that I have been involved within the last three or four years that have sought to cope with methodological dilemmas. One study focused mainly on the question of mixed land uses and their effects on commuting using a database that contains numerous control variables, the American Housing Survey (AHS). The American Housing Survey provides a wealth of data on neighborhoods and travel for about 80K households across some 44 metropolitan statistical areas. Data are compiled by housing unit, not household. There is information on whether a retail, grocery, or drugstore lies within 300 feet of a surveyed residence. We created a simple dummy variable to signify whether housing units have commercial/retail activities close by and as far as a mile away. The AHS also has an ordinal measure of housing densities as well as a wealth of control variables, like household incomes, vehicle availability, and transit service adequacy. Using regression and logit models, we found the presence of neighborhood shops had the biggest effect on promoting walking and bicycle commute trips. A weakness of the AHS database, however, is that travel information is available only for work trips, for a home-to-work commute distance of one mile, a 20 percentage point differential in the probability of commuting by foot or bicycle, depending on whether someone lives in a mid-rise/high-rise mixed use setting versus a low-density single-use setting,

controlling for vehicle ownership levels and other potential explanatory factors. Thus, a single-use, mid-high rise built environment was found to produce very comparable walk commute modal splits as a low-density, mixed use one. That is, mixed land use added as much as increasing densities from low to mid-rises in encouraging non-motorized travel for commutes up to one mile in length.

Another study I recently led that tried to deal with control problems involved matching pairs of communities in the San Francisco Bay area. Because we relied on the census transportation planning packages we were forced to limit our analysis to commute trips. What we were able to do was find suitable comparison neighborhoods: one set of neighborhoods that was developed prior to World War II, at one time had a key system street car services, and higher densities yet comparable transit service levels as comparison neighborhoods. In matching neighborhoods, often lost because a more transit-oriented places tend to be rewarded with more transit services, becomes nearly impossible to remove this influence). We did not find tremendous differences in commute trip rates or modal splits among matched pairs of neighborhoods. For the seven matched pairs, there were hardly any differences in the percent of work trip made by mass transit, no more than two to three percentage point variations. Clearly other factors, like the relative price of auto travel and levels of regional accessibility, influence transit modal splits more than neighborhood designs. We also found about a 4 to 12 percentage point differential in walking modal splits between traditional neighborhoods and auto-oriented ones, controlling for income levels and other possible explainers.

In a follow-up study we focused on travel differences between two Bay Area neighborhoods that were comparable in all respects other than urban design. We actually sent out about 6,000 travel surveys to residences of two communities in the San Francisco Bay Area, Rockridge and Lafayette, both east of Oakland. The two neighborhoods are on the same Bay Area Rapid Transit District (BART) line, are served by the same freeway, and are about five miles from each other. They also have very comparable median household income levels. Besides having decidedly different built environments, the only other notable difference between the two neighborhoods is that Rockridge has a high share of students, but we netted this out of our analysis. Rockridge is a traditional neighborhood in many respects. Its main street, College Avenue, features a street wall of commercial-retail uses. Residences on cross-streets to College Avenue consist largely of California bungalows with rear in-law units. Rockridge has moderate residential densities. Lafayette is Rockridge's polar opposite. Near its BART Station one finds a completely different environment consisting of spread-out strip development surrounded largely by parking lots. We found about a 10 to 20 percent higher share of nonwork trips by non-auto modes among residents of Rockridge. Probably most importantly, we found a much higher share, 18 to 20 percent age points, of walk access trips to BART, by Rockridge residents. In the Bay Area, the vast majority of suburbanites use cars to access BART. Transit trips involving park-and-ride do absolutely no good from an air quality standpoint. Our research also showed to some degree substitution effects. Our survey asked residents to record information on up to three daily trips as opposed to a full day travel diary. Residents from both communities average around two daily nonwork trips. However, a much higher share of these two trips in Rockridge were by foot, suggesting residents reduce nonwork auto trips commensurately. We found that walking access trips, particularly to shops, were being offset by lower auto trips to nonwork destinations in Rockridge.

Lastly, in a more recent study, we conducted a similar investigation of nonwork travel for 50

Bay Area neighborhoods instead of 2. While comparisons of travel between two matched pairs might be illustrative, the results are always questionable in terms of their generalizability. Berkeley graduate students were hired over a nine-month period to collect detailed design and land use information for these 50 neighborhoods. For the 50 Bay Area neighborhood we had at least 20 household travel diary records, so there were enough data observations to say something about nonwork trips. Using factor analysis, we expressed variables by the 3D's— density, diversity, and design. Our study attempted to measure the existence of all of the things which are typically associated with transit oriented and pedestrian friendly environments for all 50 neighborhoods. The results of this study—in terms of how the built environment shapes travel demand—were mixed. The elasticities were very low. Once we controlled for income and other factors, marginal effect of density, diversity, design in explaining variations in non work trip rate and modal splits were fairly low. Several relationships were moderately strong, but for the most part once controls were introduced, it appears the 3D's exerted minimal influences.

While it is important that we can evaluate these relationships under current circumstances, we have to recognize that in an environment where we have incredibly cheap prices for motoring and parking, perhaps these findings are not that surprising. We should resist trying to write off the transportation-land use connection even when studies fail to show a big impact. The important question is: What would the effects of density, diversity, and design if we could get the prices a bit closer to what they should be? Then we would likely be able to find much more elasticity. Another important point about non work shop trips is that really very little is known about multi-leg trip behavior, or trip chaining. A fair amount of shopping is impulsive. And what impacts are major changes in retailing having? While many criticize big-box as increasing auto dependency, people going to these places might actually be making fewer trips per month. Households need to make fewer shop trips per month when shopping at big-box and wholesale retailers. Such economic and lifestyle shifts are rapidly changing dynamics of travel behavior. We certainly need to be cognitive of such profound changes as we think about future research approaches to investigating the transportation-land use connection.